Greetings and Happy New Year! Welcome to the **January 2015** edition of the WDFW Climate News Digest. Our purpose is to provide highlights of relevant climate change news, events and resources for WDFW staff. Feedback or suggestions for items to include in future editions are much appreciated – many *thanks* to those who have sent links and references and please keep them coming. Note that previous editions of the newsletter are now stored on the Habitat Program Sharepoint site and on the agency's climate change web page.

Thanks for contributions this month from Bob Vadas, Steven Kalinowski, Marc Hayes, Wendy Connally, Steve Desimone, Mike Schroeder, Sam Ricketts

## WHAT'S HAPPENING AT WDFW?

### Yakima Case Study Featured in Obama Climate Report

(submitted by Sam Ricketts, Director, Washington, DC Office | Office of Governor Jay Inslee)
The final recommendations of the President's State, Local & Tribal Leaders Task Force on Climate Resilience & Preparedness include as a highlight the Yakima River Basin Integrated Water Resource Management Plan. The recommendations urge the federal government to better "promote integrated watershed management and planning to protect water quality and quantity." Here's the excerpt on the YBIP, which you can find on page 26 of the Task Force's final report to the President:

> **Yakima River Basin Integrated Water Resource Management Plan, Washington State**
> The Yakima Basin Integrated Plan is a collaborative plan to build resilience for the river basin as climate change strains the water resources on which its farms, families and fish all depend. Having faced water challenges for decades—including five drought years in the last twenty—and with mountain snowpack expected to decline significantly, the people of the basin face grave threats to their livelihoods. Recognizing this, local, county, and tribal governments, the conservation community, irrigation districts and others joined together with State and Federal agencies on a comprehensive plan to protect and enhance habitat and improve water supply for irrigation, municipal and domestic uses.
> "The plan will provide water and habitat managers with the tools they need to cope with the anticipated detrimental effects of climate change on snowpack and streamflows. Basin stakeholders…chose to set aside their personal interests and work together to formulate a comprehensive set of solutions that benefit the basin as a whole."
> - Governor Jay Inslee, State of Washington

## CLIMATE ADAPTATION AT OTHER ORGANIZATIONS

### Federal Climate Change Adaptation Plans

When he laid out his Climate Action Plan to cut carbon pollution, prepare communities for the impacts of climate change, and lead international efforts to reduce emissions, President Obama reiterated his commitment to leading by example in the Federal Government. The President directed agencies to assess their vulnerabilities to climate change impacts in Climate Change Adaptation Plans and outline how they will protect Federal programs, assets, and investments.
Click here to learn more about Federal Climate Change Adaptation Plans.

### Corps of Engineers releases Climate Change Adaptation, Strategic Sustainability plans

- 2014 Strategic Sustainability Performance Plan (PDF)
- U.S. Army Corps of Engineers Climate Change Adaptation Plan (PDF)

The United States Army Corps of Engineers released its Climate Change Adaptation Plan and annual Strategic Sustainability Plan in response to Executive Orders 13514 and 13653.

## LEARNING OPPORTUNITIES

**January 14th -- Workshop: Using Beaver to Restore Streams, Everett, WA**
Using beaver to restore streams is rapidly gaining acceptance as a cost-effective technique to improve aquatic habitat, especially for salmonids. Join us for an intensive 1-day workshop symposium for the beta release of a state-of-the-science manual regarding the use of beaver to restore streams. This workshop is part of a 2013 NPLCC funded project with Portland State University and USFWS and is intended for practitioners, reviewers, funders, landowners, land managers and regulators. Learn more here.

**January 23rd, 11:00-12:00, Pacific, "Wood Replenishment: A Superhero in the Battle against Climate Change"**
Presented by: Scott Nicolai, Yakama Nation Fisheries. For more information on the topic, presenter and how to register, click the link below.
http://nctc.adobeconnect.com/rwsjan15/event/event_info.html

**Climate Academy**
This 6 month online course is designed to cover the fundamentals of climate science, provide tools and resources for climate adaptation, and increase climate literacy and communication. Beginning in February 2015, a webinar session will be held every other week for 5 months for a total of 10 sessions (participants will be asked on the application what day and time of the week is best for a 1.5 hour webinar session). Pre-webinar assignments, class resources and discussion forums will be accessed through Moodle, a distance learning platform (no special software required). Course participants will then develop a final product (such as a report or presentation) addressing climate change in their management of natural resources.

## RESOURCES

**IPCC's "Synthesis Report" and "Summary for Policymakers", were released Nov 2.**
The synthesis and summary integrate the main points from about 3000 pages of material contained in the IPCC's three assessment reports issued over the past year. The key purpose of the Synthesis Report and Summary for Policy Makers is to inform upcoming climate change meetings by world leaders. "The IPCC summary states clearly that global warming is happening, that humans have caused it, that it is already dangerous, and that the warming trend could be irreversible. It makes it clear that urgent emissions reductions are required in the very near future to keep warming below two degrees Celsius to avert the worst impacts of climate change. These include extreme weather, rising sea levels, and increased heat waves, flooding and droughts. The report also suggests climate change could aggravate violent conflicts and refugee problems and have a negative effect on food production.
The link below is for a short, user-friendly description:
http://www.dw.de/un-warns-of-irreversible-climate-change/a-18027685

**Climate change vulnerability and adaptation in the North Cascades region, Washington**

A report was recently released on the largest climate change adaptation effort on federal lands to date. The project was led by the U.S. Forest Service's Portland-based Pacific Northwest Research Station and represents collaboration among members of the North Cascadia Adaptation Partnership, including the Mount Baker-Snoqualmie National Forest, the Okanogan-Wenatchee National Forest, the North Cascades National Park Complex and Mount Rainier National Park. The UW's Climate Impacts Group provided scientific expertise: http://www.treesearch.fs.fed.us/pubs/47131 For more information, contact Snover at 206-221-0222 or aksnover@uw.edu and Peterson at 206-732-7812 or wild@uw.edu.

**EPA Draft Report Out for Comment: "Regional Monitoring Networks to Detect Climate Change Effects in Stream Ecosystems"**

EPA has released a draft of a document titled, "Regional Monitoring Networks to Detect Climate Change Effects in Stream Ecosystems." The document was prepared by the National Center for Environmental Assessment within the EPA Office of Research and Development. It describes EPA's efforts to work with its Regional offices, States, Tribes, and other organizations to establish Regional Monitoring Networks. These Networks will allow biological, thermal, and hydrologic data to be collected from freshwater, wadeable streams to quantify and monitor changes in baseline conditions, including climate change effects. EPA is releasing this draft document for the purposes of public comment and in connection with pre-dissemination peer review. Comments should be submitted in writing and must be received by EPA by December 29, 2014. For more information about submitting comments and to access the draft report, visit: http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=295758.

**Interactive Climate Data -- NOAA View Data Exploration Tool**

Explore more than 100 environmental variables from NOAA's archive of satellite images, climate model results, and other observations with this easy-to-use exploration tool. See more maps and data products on Climate.gov...

**U.S. Geological Survey Western Ecological Research Center Looks at Coastal Ecosystem Response to Climate Change**

Researchers at the U.S. Geological Survey Western Ecological Research Center and their partners are currently taking a local site network approach to describe current and future conditions and projected responses of coastal ecosystems to climate change. In partnership with the University of California at Los Angeles, and Oregon State University, the Western Ecological Research Center is leading the multidisciplinary Coastal Ecosystem Response to Climate Change program. The focus of this effort is to engage natural resource managers at coastal sites and provide them with "bottom-up" climate change understanding and adaptation at local and regional scales. Through on-the-ground data collection, experiments, and modeling, this program examines how changing ocean and atmospheric conditions will influence these estuaries. The goal of this ongoing research is to provide scientific support and information to resource and land managers for future planning and conservation of coastal ecosystems and their natural resources as our climate changes. For more information, visit: http://www.werc.usgs.gov/Project.aspx?ProjectID=222.

**Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plan**

This publication provides guidance for conducting risk-based climate change vulnerability assessments and developing adaptation action plans. The workbook helps users to identify, analyze and prioritize climate change risks. In developing an action plan, it guides users to address their most pressing risks and find appropriate responses. Climate change, once considered an issue for a distant future, has moved firmly into the present. By using the workbook and addressing climate change in their systems, users will be ready to protect environmental resources, public safety, and infrastructure. Learn more about the *Being Prepared*

*for Climate Change* workbook tools to help increase resiliency and tackle climate change in your own place. http://www2.epa.gov/cre/risk-based-adaptation

**National Science Foundation Awards Grants to Study Effects of Ocean Acidification on Marine Ecosystems**

The National Science Foundation has awarded $11.4 million in new grants through its Ocean Acidification program to foster research on the nature, extent, and effects of ocean acidification on marine environments and organisms. Grantees will research questions such as: Will regional differences in marine chemistry and physics increase acidification? Are there complex interactions, cascades and bottlenecks that will emerge as the oceans acidify, and what are the ecosystem implications? If current trends continue, how far-reaching will the changes be? To learn more about the 2014 awardees, their institutions, and projects, visit: http://www.nsf.gov/news/news_summ.jsp?cntn_id=132548&WT.mc_id=USNSF_51&WT.mc_ev=click.

## CLIMATE SCIENCE NEWS

**2014 Arctic Report Card**

The latest installment of NOAA's Arctic Report Card confirms that Arctic air temperatures are rising at more than twice the rate of the planet as a whole. The amount of ice that survives the summer melt season is shrinking, and water temperatures are rising. Some polar bear populations are declining. The number of snow days is falling. The Greenland Ice Sheet is becoming less able to reflect incoming sunlight.
Access the Report »
View the NOAA Press Release »
Climate.gov Visual Highlights »

**Arctic warming: Scientists identify new driver**

*(from Science Daily)* A mechanism that could turn out to be a big contributor to warming in the Arctic region and melting sea ice has been identified by scientists. They found that open oceans are much less efficient than sea ice when it comes to emitting in the far-infrared region of the spectrum, a previously unknown phenomenon that is likely contributing to the warming of the polar climate...

**New research quantifies what's causing sea level to rise**

Changes to sea level are mainly caused by thermal expansion of ocean waters as they heat, changes to the saltiness of water, and by an increase in ocean waters as ice melts and flows into the sea. The total annual sea level rise is about 3 mm per year – the question is, how much of that is from expansion and how much is from melting? This research found that amount of heating decreases with ocean depth but that every water layer, even the deepest waters, have contributed some to sea level rise. The authors also report that the sea level rise contribution from the layers 300-2000 meters is much more than previously reported. Purkey, S. G., G. C. Johnson and D. P. Chambers. 2014. Relative contributions of ocean mass and deep steric changes to sea level rise between 1993 and 2013. *Journal of Geophysical Research: Oceans*. DOI: 10.1002/2014JC010180 Online: http://www.skepticalscience.com/new-research-quantifies-sea-level-rise.html http://onlinelibrary.wiley.com/doi/10.1002/2014JC010180/abstract

**What's the coldest day of the year?**

For some states, the coldest day of the year usually occurs near the start of winter, while for others it comes near the end. This map reveals when history says your state will have its coldest day of the year.

## SPECIES AND HABITATS

**Habitat size influences food web structure in drying streams, McHugh et al -** (article available on request from Lynn)
(*excerpt from abstract) "*Biodiversity in running waters is threatened by an increased severity and incidence of low-flow extremes resulting from global climate change and a growing human demand for freshwater resources. Here we report on a detailed space-for-time survey of replicate stream food webs sampled along the perennial to drying continuum in each of fourteen different intermittent South Island, New Zealand streams. Consistent with our predictions, we found that food webs became smaller (ca 30 to ca 15 taxa, ca 20-fold reduction in stable isotope-based trophic area) and shorter (maximum trophic position [FCL] from 4.1 to 2.0, 25% reduction in predator:prey ratio) as we moved from the largest to smaller habitats. These results, and a comparison of our findings with those from a similar assessment conducted in perennial streams, suggest that there are perturbation thresholds which may trigger food web collapse when exceeded, and further imply that food webs may ultimately be ' sized ' to minimum flows rather than average flow conditions. Our work provides a basis for making general predictions about how habitat contraction, and flow loss in particular, may affect communities and additionally provides insight on mechanisms warranting further attention.

**Who Will Come to Your Bird Feeder in 2075?**
(*from Science Daily)* The distribution of birds in the United States today will probably look very different in 60 years as a result of climate, land use and land cover**. A** new U.S. Geological Survey study predicts where 50 bird species will breed, feed and live in the conterminous U.S. by 2075. While some types of birds, like the Baird's sparrow, will likely lose a significant amount of their current U.S. range, other ranges could nearly double. Human activity will drive many of these shifts. The study was published today in the journal *PLOS ONE*. "Habitat loss is a strong predictor of bird extinction at local and regional scales," said Terry Sohl, a USGS scientist and the author of the report. "Shifts in species' ranges over the next several decades will be more dramatic for some bird species than others."... *full story*

Terry L. Sohl. The Relative Impacts of Climate and Land-Use Change on Conterminous United States Bird Species from 2001 to 2075. *PLoS ONE*, 2014; 9 (11): e112251 DOI: 10.1371/journal.pone.0112251

**Winter bird communities in eastern North America are shifting, thanks partly to climate change**
Species that typically prefer warmer weather, such as chipping sparrows, Carolina wrens, and eastern bluebirds, are advancing north. http://conservationmagazine.org/2014/10/38375/

**Effects of climate change on net primary production of US rangelands**
Modeling and experimental results suggest that net primary productivity of grasslands of the interior west of the US will likely increase under future climate scenarios. Increases will not likely be uniform across the region, as grasslands dominated by warm season species responded most to temperature while cool season dominated regions responded more strongly to $CO_2$ enrichment.
Reeves, M.C.; Moreno, A.L.; Bagne, K.E.; & Running, S.W. Estimating climate change effects on net primary production of rangelands in the United States. 2014. *Climatic Change*. Online: http://www.readcube.com/articles/10.1007/s10584-014-1235-8 DOI 10.1007/s10584-014-1235-8

**Co-occurring Ponderosa pine and Douglas fir respond differently to environmental factors associated with future climate change**

A suite of recent publications in *Forest Ecology and Management* and an article in *Journal of Biogeography* address the different ways in which locally co-occurring Ponderosa pine and Douglas fir respond to environmental factors such as $CO_2$ enrichment,

Soule and Knapp analyzed patterns of water use efficiency for co-occurring Ponderosa pine and Douglas fir from 1850 to the present. They found that both species have increased exponentially increasing rates of water use efficiency but that increases were greater for Ponderosa pine and that the relationship between water use efficiency and basal area increment differed between the two species.
Soule, P.T. & P.A. Knapp. 2014. Analyses of intrinsic water-use efficiency indicate performance differences of ponderosa pine and Douglas-fir in response to $CO_2$ enrichment. *Journal of Biogeography*. DOI: 10.1111/jbi.12408 online: http://onlinelibrary.wiley.com/doi/10.1111/jbi.12408/abstract

Analysis using climate projections suggests that some coastal forests contain varieties of Ponderosa pine and Douglas fir with genotypes likely suitable for the future climate. In contrast, many inland forests will likely require either introduction of better-suited species or conversion to better-adapted genotypes. For some forests, natural reproduction should be suitable, but most lands will require forest renewal to maintain forest health, growth, and productivity.
Comparative genetic responses to climate in the varieties of *Pinus ponderosa* and *Pseudotsuga menziesii*: Reforestation. Rehfeldt, Gerald E.; Jaquish, Barry C.; Saenz-Romero, Cuauhtemoc; Joyce, Dennis G.; Leites, Laura P.; St Clair, J. Bradley; Lopez-Upton, Javier. 2014. *Forest Ecology and Management*. 324: 147-157. Online: http://www.treesearch.fs.fed.us/pubs/46902.

## Warming Effects on Maine Fishery

At *Yale Environment 360* this week, science writer Rebecca Kessler reports from New England where the waters of the Gulf of Maine are warming faster than almost any other ocean region on earth. As scientists study the resulting ecosystem changes, she writes, the gulf has become a "living laboratory" for how climate change could play out in marine environments around the world. Researchers caution that it is still unclear how much of the warming is driven by climate changes and how much is simply a result of natural variability. But the effects on the ecosystem are striking and are having profound effects on the region's fishery. Read the article.

## Sage Grouse and Climate Change

The link below is for an online presentation dealing with sage-grouse in an age of climate change.
https://usfs.adobeconnect.com/p7dwb56z0oa/?launcher=false&fcsContent=true&pb

## Vulnerability of Bull Trout in the Face of Wildfires and Climate Change

In the Pacific Northwest, climate change is anticipated to result in increased frequency, severity, and size of wildfires. Large and severe wildfires can lead to higher stream temperatures, affecting fish that rely on cold water to survive, such as the threatened bull trout. To address this issue, Oregon State University, U.S. Forest Service, and USGS researchers modeled population vulnerability of bull trout in the Wenatchee River, WA under current and future climate and fire scenarios. Analyses showed that local management, including reducing fire size and removing barriers to enhance fish population connectivity, can significantly reduce the vulnerability of bull trout to climate change. The Wenatchee River basin represents a unique configuration of threats, but many of the fundamental processes modeled occur across the range of bull trout and lessons learned may be useful in other locations.
Falke, J.A., Flitcroft, R.L., Dunham, J.B., McNyset, K.M., Hessburg, P.F., Reeves, G.H., 2014, Climate change and vulnerability of bull trout *(Salvelinus confluentus)* in a fire-prone landscape. DOI- 10.1139/cjfas-2014-0098: Canadian Journal Fisheries and Aquatic Sciences, p. online. [Details]

**Climate change is threatening the existence of the world's most amazing bird**

*(excerpt from the Washington Post)*

Rufa red knots just became the first bird ever listed under the Endangered Species Act with climate change cited as a "primary threat." Rufa red knots are among the avian world's most extreme long range flyers (especially in light of their relatively small size). They travel vast distances -- some flying over 18,000 miles -- in the course of an annual migration that begins in Tierra del Fuego, Argentina, and extends all the way up to the Canadian Arctic (and back again). According to the Fish and Wildlife Service, there has been a 75 percent decline in numbers of Rufa red knots since the 1980s. One key reason is that the birds, during their northward migration, stop off in Delaware Bay in May and dine on the buried eggs of horseshoe crabs -- a food source upon which they vitally depend. The horseshoe crab population collapse, and its after-effects, is the most immediate reason for the Endangered Species Act listing of the Rufa red knot. But on top of the crash at the Delaware Bay, there are also many other changes along the birds' vast flyway, and some of those involve climate change.

**Losing Paradise: Climate Change is Changing Mount Rainier**

*(From News Tribune of Tacoma)*

Global warming is melting Mount Rainier's glaciers at six times the historic rate. For years now, the melting has sent floods of water and rock pounding down the mountain, filling up rivers, killing old-growth forests and endangering historic national park buildings. Rob Carson reports. (News Tribune of Tacoma)

## POLICY AND MANAGEMENT - MITIGATION AND ADAPTATION

### More than 100 Washington businesses call for strong action on Climate Change by signing The Washington Business Climate Declaration

The Washington Business Climate Declaration (www.climatedeclaration.us/wa) was developed by several Washington companies seeking to illustrate the state business community's strong support for taking action to address climate change at the state and regional level and to mobilize strong business support to advance Washington's economic and energy security. Starting with support from over 80 companies, the Washington Business Climate Declaration was developed as a rolling call to action, urging the public, policymakers and other business leaders to seize the opportunity to advance the Washington's economic and energy security by tackling climate change. For more information visit: http://www.ceres.org/declaration/sign/washington-business-climate-declaration/washington-business-climate-declaration-faqs

### U.S. and China Announce Actions to Cut Carbon Pollution

Last month, in a historic joint announcement, President Obama and Chinese President Xi Jinping announced their two countries' post-2020 climate targets.

The U.S. will reduce greenhouse gas emissions by 26-28 percent below 2005 levels by 2025, and China will peak carbon emissions around 2030 while striving to peak early. China will also roughly double the share of non-fossil fuel (nuclear and renewables) in its economy-wide energy mix to around 20 percent by 2030.

This announcement was an important development in the U.S.-China relationship. The world's two largest economies, energy consumers, and carbon emitters are reaching across traditional divides and working together to demonstrate leadership together on an issue that affects the entire world.

**Read more about the U.S.-China joint announcement here.**

### Climate Education

Yesterday the White House Office of Science and Technology Policy launched a new Climate Education and Literacy Initiative to help connect American students and citizens with the best available science-based

information about climate change. A host of new commitments by Federal agencies and outside organizations were announced to develop and deploy innovative climate education approaches in K-12 classrooms, on college and university campuses, and in zoos, parks, aquariums, and museums, with the goal of educating and engaging students and citizens of all ages.
More information is available here:
http://www.whitehouse.gov/sites/default/files/microsites/ostp/climateed-dec-3-2014.pdf.

**University of Michigan Climate Center Develops Cities Impacts and Adaptation Tool**
The Cities Impacts and Adaptation Tool is a climate adaptation planning support tool for decision makers at the city level in the Great Lakes Region. The Tool provides usable data such as demographics, socioeconomic data, and both current and projected climate trends. The Tool also identifies a custom network of climate peers whose current climate reflects how another region may look in the future and provides a database of adaptation strategies pulled from action plans across the country. To access the tool, visit: http://graham-maps.miserver.it.umich.edu/ciat/home.xhtml.